



Original Research Article

OUTCOMES OF LIMBERG FLAP RECONSTRUCTION IN PILONIDAL SINUS DISEASE: A PROSPECTIVE STUDY

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ABSTRACT

Background: Pilonidal sinus disease (PSD) is a chronic inflammatory condition of the sacrococcygeal region associated with significant morbidity and recurrence. Off-midline closure techniques have demonstrated improved outcomes compared to conventional midline closure. **Objective:** To evaluate clinical outcomes, postoperative complications, and recurrence following Limberg flap reconstruction in patients with PSD.

Methods: This prospective observational study was conducted at a tertiary care center in India from January 2021 to January 2026. A total of 56 adult patients with chronic or recurrent PSD underwent rhomboid excision with Limberg flap reconstruction. Postoperative outcomes, complications, and recurrence were assessed during follow-up.

Results: Among 56 patients, 80.4% were male. Surgical site infection occurred in 5.4% of patients, seroma in 3.6%, and wound dehiscence in 1.8%. Transient paraesthesia was observed in 7.1% of patients. No flap necrosis was noted. No recurrence was observed among patients with available follow-up.

Conclusion: Limberg flap reconstruction is a safe and effective technique for PSD, associated with low complication rates and favorable short to mid-term outcomes

Keywords: Pilonidal sinus disease; Limberg flap; Rhomboid flap; Off-midline closure; Sacrococcygeal region.

INTRODUCTION

Pilonidal sinus disease (PSD) is a chronic inflammatory condition affecting the sacrococcygeal region, predominantly seen in young adults and associated with significant morbidity and impact on quality of life.^[1] It is characterized by sinus tract formation, recurrent infection, and intermittent purulent discharge. Although initially considered congenital, current evidence supports an acquired etiology involving hair penetration into subcutaneous tissue, resulting in a foreign body reaction and chronic inflammation.^[2,3]

The management of PSD remains challenging due to high rates of postoperative complications and recurrence associated with various surgical techniques. Traditional methods such as excision with secondary healing or midline primary closure have been widely used; however, these approaches are associated with prolonged healing, wound complications, and recurrence rates ranging from 10% to 60%.^[4-6] These limitations have led to the development of alternative surgical strategies aimed at improving outcomes.

Off-midline closure techniques have gained widespread acceptance as they address key etiological factors such as deep natal cleft anatomy

and midline tension. Procedures including the Karydakis and Bascom techniques aim to flatten the natal cleft and lateralize the suture line, thereby reducing hair accumulation, moisture retention, and friction factors implicated in recurrence.^[2,7]

The Limberg rhomboid flap, first described by Limberg, is one of the most commonly used off-midline reconstructive techniques for PSD.^[3] It involves rhomboid excision of diseased tissue followed by transposition of a well vascularized fasciocutaneous flap, allowing tension free closure and obliteration of the natal cleft. Several studies and meta-analyses have demonstrated that the Limberg flap is associated with lower recurrence rates, fewer wound complications, and faster recovery compared to conventional techniques.^[8-10] Despite strong evidence supporting the effectiveness of Limberg flap reconstruction, variations in reported outcomes and the need for region specific data necessitate further prospective evaluation. Therefore, the present study aims to assess clinical outcomes, postoperative complications, and recurrence rates following Limberg flap reconstruction in patients with pilonidal sinus disease in a tertiary care setting.

MATERIALS AND METHODS

Study Design and Setting

This prospective observational study was conducted in the Department of General Surgery at JIU'S IIMSR & Noor Hospital, Jalna, India, over a five-year period from January 2021 to January 2026. The study was designed to evaluate clinical outcomes following Limberg flap reconstruction in patients diagnosed with pilonidal sinus disease.

Study Population

A total of 56 adult patients with chronic or recurrent pilonidal sinus disease were included in the study. Patients were enrolled consecutively during the study period after obtaining written informed consent.

Inclusion and Exclusion Criteria

Patients aged 18 years or older presenting with clinical features of pilonidal sinus disease, including midline pits, chronic discharge, or recurrent abscess in the sacrococcygeal region, were included in the study. Patients younger than 18 years, those with uncontrolled diabetes mellitus, immunocompromised status, active acute abscess with purulent discharge, or a history of prior extensive excision with significant tissue loss were excluded.

Preoperative Evaluation

All patients underwent detailed clinical evaluation, including history taking and local examination of the sacrococcygeal region. Routine laboratory investigations were performed in all cases. Magnetic resonance imaging was selectively employed in patients with multiple sinus openings

or suspected complex tracts to assess the extent and branching of the disease.

Surgical Technique

All procedures were performed under spinal anesthesia with the patient placed in the prone jackknife position. Prophylactic intravenous antibiotics were administered at induction. Following standard sterile preparation using povidone-iodine solution, methylene blue dye was injected into the sinus tract to delineate its extent.

A rhomboid-shaped excision encompassing all diseased tissue was carried out down to the presacral fascia. A fasciocutaneous flap of equal dimensions was then designed from the adjacent gluteal region and carefully mobilized with preservation of vascular supply. The flap was transposed into the defect to achieve tension free closure and flattening of the natal cleft.

Subcutaneous closure was performed using absorbable polyglactin 2-0 sutures, while skin closure was achieved using monofilament polyamide 3-0 sutures or skin staples. A closed suction drain was placed in all patients and removed once the output was less than 20 mL over a 24-hour period.

Postoperative Care and Follow-Up

Postoperatively, patients were maintained in a prone or lateral position for 24 to 48 hours to minimize tension on the surgical site. Routine wound care was provided, and patients were advised to avoid prolonged sitting and excessive physical activity during the early recovery period.

Follow-up assessments were conducted on postoperative day 10, at one month, and at six months. Extended follow-up up to one to three years was performed where feasible.

Outcome Measures

Patients were assessed for postoperative complications including surgical site infection, seroma formation, wound dehiscence, flap necrosis, and paraesthesia. Additional parameters evaluated included duration of hospital stay, time to wound healing, and recurrence rate. Recurrence was defined as the reappearance of sinus pits, chronic discharge, or abscess formation in the previously operated region following complete wound healing.

Statistical Analysis

All data were recorded using a structured proforma and analyzed using descriptive statistical methods. Continuous variables were expressed as mean \pm standard deviation, while categorical variables were presented as frequencies and percentages.



Figure 1: Preoperative marking



Figure 2: Post rhomboid excision



Figure 3: Flap transposition



Figure 4: Immediate postoperative site

RESULTS

Demographic Profile

A total of 56 patients underwent Limberg flap reconstruction for pilonidal sinus disease during the study period. The study population demonstrated a marked male predominance, with 45 males (80.4%) and 11 females (19.6%). The age of the patients ranged from 18 to 50 years.

The duration of postoperative hospital stay ranged from 5 to 10 days, consistent with institutional discharge protocols.

Postoperative Complications

Postoperative complications were observed in a small proportion of patients. Surgical site infection occurred in 3 patients (5.4%) and was managed successfully with antibiotics and regular wound care. Seroma formation was noted in 2 patients (3.6%) and was treated conservatively with aspiration and compression dressings. One patient (1.8%) developed wound dehiscence, which required secondary suturing following local wound management.

Transient paraesthesia over the flap site was reported in 4 patients (7.1%) during follow-up; this resolved spontaneously without intervention. Importantly, no cases of partial or complete flap necrosis were observed in this cohort.

Follow-Up and Recurrence

Of the 56 patients included in the study, complete follow-up of up to three years was available for 32 patients (57.1%), while 8 patients (14.3%) were followed for at least one year. The remaining patients had shorter follow-up durations but were assessed during early and intermediate postoperative periods.

Recurrence was defined as the reappearance of sinus pits, chronic discharge, or abscess formation in the previously operated sacrococcygeal region after complete wound healing. No cases of recurrence were identified among patients with available follow-up during the study period.

Clinical Outcomes

Overall, Limberg flap reconstruction demonstrated favorable clinical outcomes with low complication rates, absence of flap necrosis, and satisfactory

wound healing. The procedure was well tolerated, and most complications were minor and managed conservatively.

Table 1: Sex distribution

Gender	Number of Patients	Percentage
Male	45	80.4%
Female	11	19.6%
Total	56	100%

Table 2: Distribution of postoperative complications following Limberg flap reconstruction showing the number of affected patients (n = 56).

Complications	Number (n=56)	Percentage
Surgical site infection	3	5.4%
Seroma	2	3.6%
Wound dehiscence	1	1.8%
Flap necrosis	0	0%
Paraesthesia	4	7.1%
Recurrence	0	0%

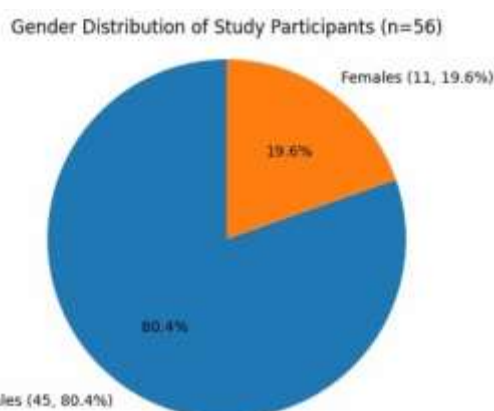


Figure 5: Sex distribution of patients who underwent Limberg flap reconstruction for pilonidal sinus disease (n = 56)

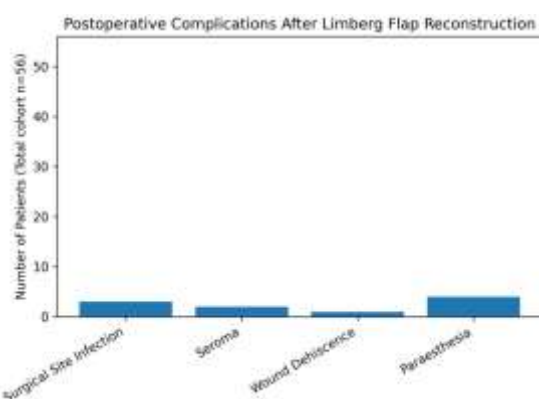


Figure 6: Distribution of postoperative complications following Limberg flap reconstruction showing the number of affected patients (n = 56)

DISCUSSION

The present prospective study evaluated the clinical outcomes of Limberg flap reconstruction in 56 patients with pilonidal sinus disease over a five-year period. The findings demonstrate that the Limberg flap is associated with low postoperative morbidity and favorable outcomes, with no

recurrence observed among patients with available follow-up. Postoperative complications were minimal, including surgical site infection in 5.4%, seroma in 3.6%, and wound dehiscence in 1.8% of patients, while no cases of flap necrosis were reported.

Pilonidal sinus disease continues to pose a surgical challenge due to its high recurrence rates and postoperative complications. Traditional techniques such as excision with midline closure have been associated with recurrence rates ranging from 10% to 60%, largely attributed to persistent deep natal cleft anatomy and tension along the midline suture line.^[5,6] These limitations have led to a paradigm shift toward off-midline closure techniques that aim to address the underlying etiological factors contributing to recurrence.

The pathogenesis of pilonidal sinus disease is now widely accepted as acquired, involving hair penetration, friction, and chronic inflammation within a deep intergluteal cleft.^[2,10] Consequently, surgical techniques such as the Karydakias and Bascom procedures have been developed to flatten the natal cleft and lateralize the suture line, thereby reducing recurrence-promoting factors.^[2,7] However, among these techniques, the Limberg flap has gained particular attention due to its reproducibility and favorable outcomes.

The Limberg rhomboid flap enables wide excision of diseased tissue followed by tension-free closure using a well-vascularized fasciocutaneous flap. High-level evidence from systematic reviews and meta-analyses supports its effectiveness. Ray et al. reported significantly lower recurrence rates with the Limberg flap compared to Karydakias and Bascom procedures.^[13] Similarly, a network meta-analysis by Bi et al. demonstrated that Limberg flap and other off-midline techniques are associated with superior outcomes and reduced recurrence rates.^[14]

In the present study, postoperative complication rates were low and consistent with previously

published data. Surgical site infection occurred in 5.4% of patients, seroma in 3.6%, and wound dehiscence in 1.8%, all of which fall within the lower range of complication rates reported in the literature (5–15%).^[13,14,19] Notably, no cases of flap necrosis were observed, highlighting the reliability of the flap's vascular supply when meticulous surgical technique is employed.

The demographic profile observed in this study, with a predominance of male patients (80.4%) and an age range of 18–50 years, is consistent with established epidemiological patterns.^[10] Transient paraesthesia was noted in 7.1% of patients, likely due to minor sensory nerve disruption during flap mobilization, and resolved spontaneously during follow-up.

An important finding of this study is the absence of recurrence among patients with available follow-up. Comparable studies have reported recurrence rates ranging from 0% to 3% following Limberg flap reconstruction,^[19] which is significantly lower than those associated with conventional midline closure techniques.^[5,6,12] Furthermore, long-term studies emphasize that recurrence can occur several years after surgery, underscoring the importance of extended follow-up in such patients.^[11]

From a clinical perspective, the findings of this study reinforce the advantages of off-midline closure techniques in reducing recurrence and improving wound healing outcomes. The Limberg flap not only facilitates tension-free closure but also effectively flattens the natal cleft, thereby addressing key etiological factors associated with disease recurrence.

Despite these favorable outcomes, certain limitations must be acknowledged. This study was conducted at a single center and lacked a comparative control group, which may limit the generalizability of the findings. Additionally, long-term follow-up was not available for all patients, which may influence the accuracy of recurrence assessment.

CONCLUSION

Limberg flap reconstruction is a safe and effective technique for pilonidal sinus disease, associated with low complication rates and no recurrence observed during follow-up. It remains a reliable option for surgical management in clinical practice.

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